**Efficient two-derivative Runge-Kutta-Nyström methods for solving general second-order ordinary differential equations y"(x) = f(x,y,y')**

ABSTRACT

This paper proposes and investigates a special class of explicit Runge-Kutta-Nyström (RKN) methods for problems in the form y" (x) = f (x,y, y') including third derivatives and denoted as STDRKN. The methods involve one evaluation of second derivative and many evaluations of third derivative per step. In this study, methods with two and three stages of orders four and five, respectively, are presented. The stability property of the methods is discussed. Numerical experiments have clearly shown the accuracy and the efficiency of the new methods.

**Keyword:** Runge-Kutta-Nyström; Second derivative; Third derivative; Differential equations